

AD-A195 861

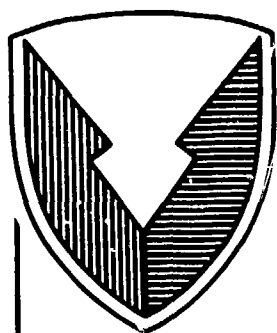
URG FILE COPY

4

RD & E

C E N T R

# Technical Report



No. 13364

T-159 TRACK WITH FULL AREA  
REMOVEABLE GROUND PAD  
6/8/88

DTIC  
ELECTE  
JUL 06 1988  
S D  
H

A.B. Kendall  
The Standard Products Co.  
215 Maple Street  
Port Clinton, Ohio  
43452

By

APPROVED FOR PUBLIC RELEASE:  
DISTRIBUTION UNLIMITED

U.S. ARMY TANK-AUTOMOTIVE COMMAND  
RESEARCH, DEVELOPMENT & ENGINEERING CENTER  
Warren, Michigan 48397-5000

88 6 30 080

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

## REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188  
Exp. Date Jun 30, 1986

1a. REPORT SECURITY CLASSIFICATION <b>Unclassified</b>			1b. RESTRICTIVE MARKINGS <b>None</b>		
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION/AVAILABILITY OF REPORT <b>Approved for Public Release. Distribution Unlimited.</b>		
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE					
4. PERFORMING ORGANIZATION REPORT NUMBER(S) <b>4709</b>			5. MONITORING ORGANIZATION REPORT NUMBER(S)		
6a. NAME OF PERFORMING ORGANIZATION <b>The Standard Products Company</b>		6b. OFFICE SYMBOL (if applicable) <b>Code - 98761</b>	7a. NAME OF MONITORING ORGANIZATION <b>U.S. Army Tank-Automotive Command</b>		
6c. ADDRESS (City, State, and ZIP Code) <b>Port Clinton, Ohio 43452</b>		7b. ADDRESS (City, State, and ZIP Code) <b>Warren, Michigan 48090</b>			
8a. NAME OF FUNDING/SPONSORING ORGANIZATION <b>U.S. Army Tank-Automotive Command</b>		8b. OFFICE SYMBOL (if applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER <b>DAAE07-86-C-R008</b>		
8c. ADDRESS (City, State, and ZIP Code) <b>Warren, Michigan 48090</b>		10. SOURCE OF FUNDING NUMBERS			
		PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) <b>T-159 Track with Full Area Removeable Pad - Unclassified</b>					
12. PERSONAL AUTHOR(S) <b>A.B. Kendall</b>					
13a. TYPE OF REPORT <b>Final</b>		13b. TIME COVERED <b>FROM 12-31-85 TO 3-31-88</b>		14. DATE OF REPORT (Year, Month, Day) <b>April 29, 1988</b>	
				15. PAGE COUNT <b>13</b>	
16. SUPPLEMENTARY NOTATION					
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP	Pad Metal Insert		
			Ground Pad		
			Shoe Deckplate		
19. ABSTRACT (Continue on reverse if necessary and identify by block number) The T-159 track fabricated under contract DAAE07-86-C-R008 is intended to be used on the M1 tank. It is dimensionally the same as the T-156 track now used. The track pitch has been designed to have replaceable road pads to allow for the difference in wear rates between the road wheel side and the ground pad side without the large weight penalty exacted by forged or cast shoes. By using a replaceable pad in the area of greatest wear the overall life of the track should be increased substantially. The test tracks are being supplied with four different combinations, utilizing two ground pad designs and two track shoe designs.  Connecting hardware consists of clamp type end connectors as used on T-150, T-154 and T-153 track designs and a domed double-bolted center guide as used on the T-158.  One vehicle set of tracks has been shipped to Yuma Proving Ground for field testing. -(R.H.)					
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION <b>Unclassified</b>		
22a. NAME OF RESPONSIBLE INDIVIDUAL <b>Dennis Sweers</b>			22b. TELEPHONE (Include Area Code) <b>313-574-6114</b>		22c. OFFICE SYMBOL <b>AMSTA-RTT</b>

## PREFACE

The author wishes to acknowledge the help of those people who made this report possible:

Dennis Sweers, Project Engineer, TACOM; Joe Fix, Project Engineer, TACOM; and George Nichols, Military Coordinator, Standard Products, now retired.



Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

## TABLE OF CONTENTS

Section	Page
1.0. INTRODUCTION .....	5
1.1. <u>Removeable Pads</u> .....	5
1.2. <u>Test Track</u> .....	5
2.0. OBJECTIVE .....	5
3.0. CONCLUSIONS .....	5
4.0. RECOMMENDATIONS .....	5
4.1. <u>Track Pad</u> .....	5
4.2. <u>Pad Mounting Hardware</u> .....	6
4.3. <u>Shoe Metal</u> .....	6
5.0. DISCUSSION .....	6
5.1. <u>Background</u> .....	6
5.2. <u>Design</u> .....	7
5.3. <u>Track Shoe</u> .....	7
5.4. <u>Ground Pad</u> .....	9
5.5. <u>Connector Pins</u> .....	9
5.6. <u>Connecting Hardware</u> .....	12
5.7. <u>Testing</u> .....	12
DISTRIBUTION LIST .....	.Dist-1

## LIST OF ILLUSTRATIONS

Figure	Title	Page
5-1.	T-159 Shoe Pitch .....	8
5-2.	T-159 Shoe Metal Inserts .....	10
5-3.	Molded Pad with Two Styles of Pad Metal Insert .....	10
5-4.	View of Bottom of Molded Shoe without Road Pad in Place .....	11

## 1.0. INTRODUCTION

This final technical report, prepared by Standard Products Co., under Contract DAAE07-86-C-R008, for the U.S. Tank-Automotive Command, describes the design and development of a new track for the M1 vehicle. The track is dimensionally identical to the T-156 track except for the addition of full area or parade ground style ground contract rubber.

### 1.1. Removeable Pads

The track differs from the standard T-156 track by having removable road pads that can be replaced when they have worn away. The general style of construction of the T-156 has been maintained. Track weight will be increased by only approximately 700 lbs.

### 1.2. Test Track

There have been four variations of track pitch assembled for test using two variations of pad metal insert and two variations of shoe metal insert. The four styles essentially provide, from a minimum amount of support to the rubber road wheel path and ground path areas, to a maximum support for these areas consistent with this type of construction.

## 2.0. OBJECTIVE

The primary goal of this contract is to design a track that will fit the M1 vehicles and have a useful life two or three times that of the present T-156 track. The track will fit the drive sprockets and road wheels as they presently exist. The design is to be accomplished without exacting an unacceptable weight penalty on the vehicle and diminishing its battle effectiveness.

## 3.0. CONCLUSIONS

The T-159 track as designed has been readily capable of manufacture. Alternative methods have shown themselves but were unable to be investigated under the present contract. When field testing has been completed, on the present track, new methods may be indicated for investigation, to add to what has been accomplished here.

## 4.0. RECOMMENDATIONS

### 4.1. Track Pad

Track pad size should be reduced to allow for some economies of molding. An alternative might be to injection mold the pad. The full area pad, compression molded, takes too long at much too low a temperature to mold.

#### **4.2. Pad Mounting Hardware**

Instead of the bolt attached to the pad metal to which we add the nut to hold it on the shoe, the opposite might be tried; imbed the nut in the pad metal and use a bolt to attach to the shoe metal. There would be less clearance needed on the pad to allow it to mount in place.

4.2.1. Pin Mounting. The pin mount at end of pad could be replaced with larger pins with a tapped center hole. As well as being mounted in hole in shoe, a bolt could be added to hold it in place.

4.2.2. Construction. Brazing or a combination of brazing and spot welding should be used to mount pad stiffener metal to basic pad metal. The strength would be improved.

#### **4.3. Shoe Metal**

The shoe with additional deck welded in place would be better if everything including the deck was designed to be brazed in place.

### **5.0. DISCUSSION**

#### **5.1. Background**

The T-156 track used on the M1 vehicle has long been recognized as inadequate for the weights and speeds imposed. The track block is molded as a unit without replacement rubber parts. As a consequence, the pitch is unusable as soon as the ground pad side has worn or chunked away.

5.1.1. Removeable Pad. In 1981 Standard Products undertook to design a track with the same physical outline as the T-156 but with a removeable pad. This would allow the more expensive part of the track pitch to wear out a succession of road pads without any replacement of wheel path rubber.

5.1.2. Testing. Five pitches of this track were fabricated under contract DAAE-07-81-C-4091 and were given to Chrysler for test at Chelsea Proving Grounds. These pitches went approximately 250 miles at Chelsea plus another 250 miles at Yuma. The failure appeared to be tearing of the pad metal near the mounting bolt and pins.

5.1.3. New Design. It was felt that these problems could be eliminated by addressing them directly in the design. The five pitches that were tested under the previous contract were essentially the same as the T-156 with slight changes to mount the road pad. There was no attempt to limit the flexing of the pad metal inserts.

5.1.4. Standard Hardware. The end connectors used on the original five pitches were standard wedge-type connectors and the center guide was the standard single bolt design.

## 5.2. Design

The T-159 track is intended as an alternative track for the M1 vehicle. The track dimensions are to be approximately the same as the T-156 track presently used so that there will be no change in road wheel or sprocket hardware when mounting the track to the vehicle. The track is intended to make use of a removeable road pad molded assembly but without the weight penalties that would be present in a forged or cast-type shoe such as the T-142.

5.2.1. Hardware Development. Some of the more successful concepts in recent years of track design were incorporated in the design (See Figure 5-1).

- Dome-type double-bolted center guides used on the T-158 tracks were designed into the T-159.
- Clamp-type end connector used on T-150, T-154, and T-158 was incorporated in T-159.
- Connector pins with the flats for the end connectors stamped in place rather than machined were used in the T-159 design.

The final design provided for two types of shoe metal inserts and two types of pad metal inserts. During final assembly of the track these were combined to form four combinations for test in the field. Because of the differing amounts of metal in the inserts the track pitch weight varied approximately 3 lbs. pitch:

- Track shoe without center deck and pad metal without reinforcement. = 66.16 lbs/pitch
- Track shoe with center deck and pad metal without reinforcement. = 67.33 lbs/pitch
- Track shoe without center deck and pad metal with reinforcement. = 68.22 lbs/pitch
- Track shoe with center deck and pad metal with reinforcement. = 69.38 lbs/pitch

## 5.3. Track Shoe





Fig. 5-1. T-159 Shoe Pitch  
(Link assembly shown with one pad removed and standing at right. On left is clamp-type end connector with bolt. In center is double bolted center guide assembly borrowed from T-158 track.)

5.3.1. Basic Construction. The track shoes were essentially fabricated in the same way as the T-156. Tubes were cut to length and brazed into end plates. The center aluminum tube of the T-156 was left out and in its place were put tongue extensions forged to the end plates. These tongue extensions were used to support the ground pad and also to mount the ground pad. (See Figure 5-2). Rubber was molded to the shoe forming a road wheel path. The bottom of the molded rubber was held flush with the bottom of the tongue forged to the end plates. (Figure 5-4). The road wheel path rubber is now supported by the pad metal insert and the ground pad rubber is in turn supported by the metal backing plate and the tongue extensions from the end plates.

5.3.2. Reinforcement. A second type of track shoe insert was made from the original by welding a stamped steel plate flush with the bottom of the tongue forged to each end plate. The plate was welded to the tubes and to the tongues at the end plates. (See Figure 5-2). This provided a support in the shoe for the road wheel path rubber and also supplies a support for the ground pad rubber insert.

#### 5.4. Ground Pad

The ground pads were molded as full area pads for wear rather than having a molded grouser bar to improve traction through greater soil penetration. The pads have approximately 5 lbs. of rubber molded on to a back plate. Two types of metal inserts were used to make ground pads. One was formed from 11 gauge HSLA steel with no additional reinforcing. The second type of insert was formed by spot welding an 11 gauge steel plate with rolled edges to the original insert. This added lateral strength and also made a double thickness of metal under the mounting bolt head. The added metal on this pad metal insert increases the weight by approximately 1.03 lbs. (See Figure 5-3).

#### 5.5. Connector Pins

The connector pins and end connectors used were the same ones that were used on the T-158. Before we were able to manufacture pins we received work from TACOM of a possible failure point that had shown up in testing. The pins were failing at the runout area from the formed flat in the pin. The failures were initiated at a stress crack that had formed in some pins when the flats were stamped. To correct this, Gil Mar Manufacturing who were making the pins for us redesigned their tooling to reduce the degree of bending at the runout area. X-ray tests of the first six pins delivered did not show any cracking in the runout area on the redesigned pins.



Fig. 5-2. T-159 Shoe Metal Inserts  
 (At left is basic shoe insert showing mounting holes in tongue and end plate. At right is basic shoe insert with sheet metal deck welded in place.)



Fig. 5-3. Molded Pad with Two Styles of Metal Insert  
 (On left is regular unreinforced pad metal. On right is Pad Metal reinforced with formed steel backup plate spot welded in place.)

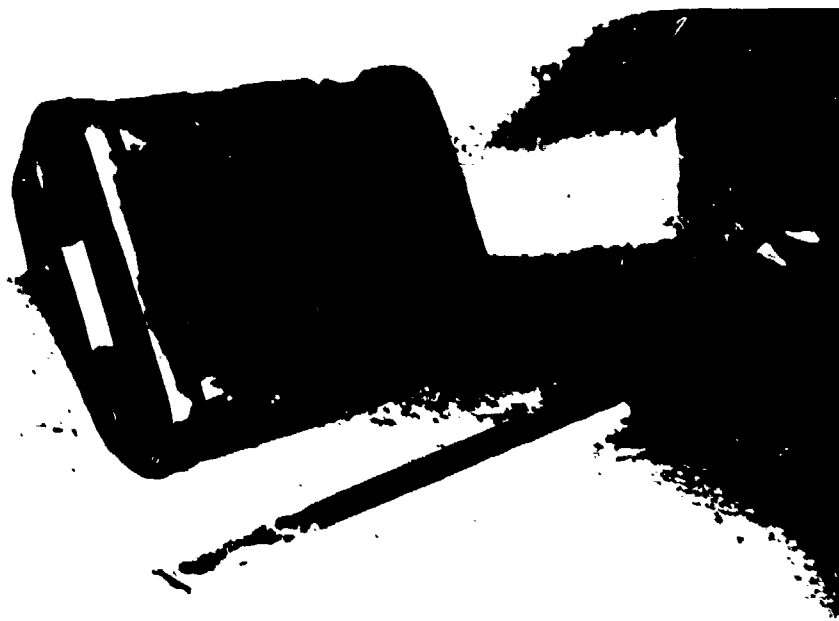


Fig. 5-4. View of Bottom of Molded Shoe without Road Pad in Place

#### 5.6. Connecting Hardware

All connecting hardware, both center guide and end connector, are the same as used on the T-158. The center guides were obtained from FMC Corp. and the clamp-type connectors were made by Gil Mar Manufacturing. The tooling for the end connectors was obtained from Molnar Manufacturing. It was the tooling originally made by Vulcan Manufacturing to fabricate end connectors for T-158.

#### 5.7. Testing

Two tracks plus spares were fabricated under contract DAAE07-86-C-R008. They were sent to Yuma Testing Grounds in December of 1987. These have not yet been tested.

## DISTRIBUTION LIST

Commander Defense Technical Information Center Bldg. 5, Cameron Station Attn: DDAC Alexandria, Virginia 22304-9990	12
Manager Defense Logistics Studies Information Exchange Attn: AMXMC-D Fort Lee, Virginia 23801-6044	2
Commander U.S. Army Tank-Automotive Command Attn: AMSTA-DDL (Tech. Library) Warren, Michigan 48397-5000	2
Commander U.S. Army Tank-Automotive Command Attn: AMSTA-CF Warren, Michigan 48397-5000	1
Commander U.S. Army Tank-Automotive Command Attn: AMSTA-RTT Warren, Michigan 48397-5000	3
Commander U.S. Army Tank-Automotive Command Attn: AMSTA-IRDA Warren, Michigan 48397-5000	1
Commander AMSAA Attn: AMXSY-MP (Mr. Cohen) Aberdeen Proving Ground, MD 21005-5071	1